# 6. BENTHIC MACROINVERTEBRATE COMMUNITY

As presented in the 24 June 1999 Study Plan, the objective of the benthic study was to characterize the macroinvertebrate community before and after a discharge event to determine if effects were observed. In the previous benthic study by Dynamac (1992) a Ponar grab sampler was used to obtain benthic samples but it was determined to be inefficient due to the highly variable quantity of sediment that would be obtained over time from the study area. As noted by the Dynamac researchers,

> *"often…sediment could be collected from a particular location during one survey, and none would be collected during the next survey. The bottom sediments are apparently being continually redistributed, keeping the benthos in a constant state of disturbance*" (Dynamac 1992, p. 68).

Based on this observation, the sampling approach selected for the present study was to set Hester-Dendy artificial substrate samplers at upstream and downstream locations in the Potomac River. Typically, Hester-Dendy samplers are deployed in the euphotic zone (< 1 meter from the water surface) to allow periphyton growth, but to better address the potential impacts associated with the Aqueduct discharge, specifically the potential sedimentation and smothering effect of the benthos, the samplers were set on concrete blocks slightly above the bottom.

## 6.1 METHODS

The experimental design presented in the EPA-approved Study Plan included upstream versus downstream comparisons, as well as before versus after a solids discharge event from Outfall 003. To accomplish this, two sets of Hester-Dendy samplers with four replicates per set were deployed on 9 March 2000 at each of five locations: one reference site (UP1) located upstream of Outfall 003 and at four downstream locations (DS1, DS2, DS3 and DS4) (Figure 6-1). Upstream and downstream locations were selected to ensure reasonable comparability of key characteristics including river velocity and depth. Matching habitat characteristics at all stations as closely as possible is necessary to minimize benthic community differences due to habitat. A formal habitat assessment was conducted at each station location at the time of site selection and placement. Each Hester-Dendy sampler consists of eight 3 x 3 inch square masonite plates separated from each other by distances of 0.25 to 0.80 cm. These spaces are intended to allow different species of benthic macroinvertebrates to colonize the Hester-Dendy units over time. Two Hester Dendy samplers were attached to each concrete patio block so the plates were horizontal to the substrate and only a few inches above the sediment interface [Photo 6-1]. Each of the four blocks was tethered to a float at each station [Photo 6-2]. All samplers were set in 8

to 10 feet of water (below extreme low tide) with the blocks in close proximity to each other (approximately 5 feet apart). The first set (4 Hester-Dendy samplers) was retrieved on 27 April 2000, 5 days before the 3 May 2000 discharge event; and the second set was collected on 8 May 2000, 5 days after the event. During retrieval, observation of samplers and associated sediment were made for each block. A nylon mesh bag was placed over each sampler before it was removed from the water to prevent loss of organisms [Photo 6-3]. After each block was retrieved the Hester-Dendy samplers were removed from the blocks, each sampler enclosed in the mesh bag was placed in a labeled 1L polyethylene jar, preserved with 10 percent formalin, and transported to EA's Biology Lab for processing.

In the lab, each Hester-Dendy sampler was disassembled, placed in a 500 micron sieve, rinsed to remove the formalin, and gently scraped to remove the debris and organisms. The sieved material was then placed in a gridded dish and with the aid of a microscope all organisms were removed. The organisms were then placed in vials and preserved in 75 percent ethanol until identified by the taxonomist. The organisms were identified to the lowest practical taxon including the chironomid midges and oligochaete worms which were mounted on slides for microscopic viewing.

## 6.2 RESULTS

The benthic macroinvertebrate results are presented below. Section 6.2.1 presents the pre-discharge data and observations, and Section 6.2.2 presents the post-discharge data.

### 6.2.1 Pre-Discharge Data

The pre-discharge Hester-Dendy retrieval was conducted on 27 April 2000. During the 49 day colonization period, the Potomac River flows fluctuated between below average, typical high spring flow, and some days above the historical median daily streamflow (25,690 cfs, based on 70 years of U.S.G.S record) (Figure 6-2). The influence that the high river flow and sediment load had on sampler performance will be discussed below. One sampler block at Station DS3 was moved (vandalism or high flow related) approximately 100 feet towards mid-river so the data for replicates A and B are not valid for comparison. The habitat assessment conducted at all stations demonstrated that habitat characteristics were very similar at all locations.

The number of organisms collected at most stations was extremely low at both the upstream reference station (UP1), and the downstream stations.

- The upstream reference area (UP1) had the lowest abundance of any of the pre-discharge stations. Replicate values were 2, 4, 3, and1 with a mean of 2.5 organisms per Hester-Dendy unit.

- The highest abundance was at Station DS4 ranging from 35 to 65 organisms per replicate and the mean number for the four replicates was 49 (Table 6-1). Two of the replicates (on the same block) at DS1 were also high at 64 and 86 organisms but the mean was 43 organisms since the replicates on the other block only had 3 and 18 organisms.

- The other high organism numbers were from the block which was moved approximately 100 feet off-station at DS3, with 120 and 60 organisms, in contrast to the Station DS-3 replicates which were at the original station location which had 5 and 2 organisms.

The Station D53 block with the high organism numbers was moved towards the center of the river and was located behind a large exposed rock formation. Also, when it was retrieved, it was evident that it was resting on hard, probably rock bottom. There was a large number of snails, Gastropoda, on the moved DS3 replicates, which were also found in moderate abundance at Station DS4.

Observations made during retrieval help to explain the differences in abundance between sites and even replicates at the same site. During collection, every attempt was made to retrieve the samplers slowly to prevent the sediment and organisms from being dislodged from the Hester-Dendys as they were brought up from the bottom. As the nylon bags were being slipped over the samplers, (while they were still in the water) it was observed that different amounts of sediments covered the patio blocks and in some cases even the Hester-Dendy samplers. The sediment was very soft and unconsolidated so the amounts could only be estimated assuming that some material probably was sloughing off during retrieval. Some blocks were obviously totally covered with sediment since it took significant effort to break it free from the bottom initially [Photo 6-4]. The replicates with the higher abundance of organisms had approximately ½ inch of sediment on top of the block, which only contacted the bottom plates of the Hester-Dendy units. The DS3 block that was moved only had a thin film of sediment on its concrete surface and none on the sampler plates. The other samplers had 1 to 2 inches of sediment on some blocks and as much as 4 inches at some stations, which was observed covering the entire sampler when retrieved.

RIVER SEDIMENT AMOUNTS OBSERVED ON HESTER-DENDY BLOCKS DURING PRE- AND POST- DISCHARGE SAMPLER RETRIEVAL

| | STATION | | | | |
|---|---|---|---|---|---|
| DATE | UP1 | DS1 | DS2 | DS3 | DS4 |
| 27 April 2000 | 3-4” | 0.5 –1” | 3” | 1-2” | 0.5” |
| 8 May 2000 | 3” | 1” | 2-3” | 2” | 0.5” |

This sediment was deposited on the sampler at some time(s) during the colonization period, which compromised the sampling efficiency of the artificial substrate samplers and diminishes the value of the data for trend detection. What was clearly demonstrated by this study was that deposition of large amounts of sediment is probably a natural and regularly occurring process in this reach of the Potomac River. During the pre-discharge retrieval, the river was high, very turbid, and there was a notable amount of debris (e.g. logs, sticks) in the water indicating that sediment was probably continuing to be deposited. Even at the upstream reference, (which had up to 4 inches of sediment covering the block) and the stations downriver of Outfall 003, sediment deposition is periodically occurring at a high rate. This part of the river is wider than the area upstream of Fletchers Landing, slower velocity and shallower on the left bank, plus tidally influenced, which can result in deposition of larger amounts of sediment during high flow events.

### 6.2.2 Post-Discharge Data

Ten days later (five days after the 3 May 2000 discharge event) the second set of Hester-Dendys were retrieved. Station DS4 again had the highest abundance with a mean of 49 organisms, similar to the pre-discharge samples, followed by UP1 with a mean of 14 organisms (Table 6-2) which was somewhat higher than pre-discharge collection (mean of 3 organisms) but still far less than expected for spring time deployment of a Hester-Dendy sampler. Oligochaete worms, which are infaunal organisms adapted to living in sediment, were the dominant organisms at UP1. Station DS1 had considerably fewer organisms than pre-discharge (43 vs 0.3) but mean abundance at the other stations was almost identical (Table 6-1). Considering the close proximity of DS1 to Outfall 003, (40 m downstream) scouring of the substrate as a result of the discharge event *may* account for the lower abundance in the post-discharge sampler. Note that the amount of sediment covering the concrete blocks and Hester-Dendy samplers was very similar to the pre-discharge amounts with no visual evidence between pre and post discharge. There was slightly more sediment at DS1 but only about ½ inch more than in the pre-discharge survey.

RIVER SEDIMENT AMOUNTS OBSERVED ON HESTER-DENDY BLOCKS DURING PRE- AND POST- DISCHARGE SAMPLER RETRIEVAL

| | STATION | | | | |
|---|---|---|---|---|---|
| DATE | UP1 | DS1 | DS2 | DS3 | DS4 |
| 27 April 2000 | 3-4” | 0.5 –1” | 3” | 1-2” | 0.5” |
| 8 May 2000 | 3” | 1” | 2-3” | 2” | 0.5” |

The number of taxa in the pre- and post-discharge collections exhibited similar trends at most stations (Tables 6-3 and 6-4). Station DS4 had a mean of 13 taxa pre-discharge and 11 taxa post-discharge. In contrast, Station DS1 had a mean of 16 taxa pre-discharge due to the two high replicates and 0.3 taxa post discharge. Station UP1 had a mean number of taxa of 2 in pre-discharge samples and 6 taxa in post-discharge. At DS2 and DS3 the mean number of taxa was less than 4 taxa in the pre and post-discharge samples.

The number of “EPT taxa”, which are pollution sensitive taxa in the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), was very low at all stations in both the pre and post-discharge samples. The greatest number of EPT taxa was 2 in some replicates of DS4 during both surveys, and DS1 in one replicate in the pre-discharge survey. Many replicates at the other stations, including at UP1, the upstream reference, had zero EPT taxa in the pre and post-discharge surveys.

The dominant taxa at all stations had “tolerance values” that indicate that most taxa were generally pollution tolerant. Only one taxa, (the snail *Pleurocera* which was a dominant at DS4), was classified as sensitive. Tolerance values were available in the literature for 65 taxa that were collected during both surveys and only 8 of those taxa were considered somewhat sensitive.

## 6.3 SUMMARY AND CONCLUSIONS

The original intention of the study design was to compare downstream conditions against upstream (reference area) conditions; and to compare the after discharge data to the before discharge data. The observations and conclusions from this study are as follows:

The substrate in the study area consists of areas of sand, mud, boulders and bedrock. Large bedrock formations were evident along the shoreline and also out in mid-river where they were above the water surface during low tide. The softer sediments are in patches between or on these rock substrate areas. The sediment depth varies substantially as evidenced by the Dynamac

(1992) study which noted that at some locations it required several grabs with a Ponar sampler to fill a sample jar. They also noted that the amount of sediment present was highly variable from one sampling event to another as demonstrated by the inability to collect any substrate from a location where it was collected previously. This supports the concept that sediments are apparently being continually redistributed following medium to high flow events which was confirmed by our observations of sediment deposition during the Hester-Dendy study. Based on the pre- and post-discharge collections, a very large load of sediment naturally moves through this segment of the Potomac River during increased flows, and deposits in the wider, slower current velocity reach of the river. This was evident from the downstream stations as well as the upstream reference station (UP-1). These large sediment loads, which resulted before the Georgetown basin discharge event, compromised the resulting dataset that was collected using the Hester-Dendy sampling approach. So much sediment covered some of the Hester-Dendy units that organisms could not colonize the sampler resulting in lower than expected numbers of benthic organisms and taxa. These low numbers of organisms affect the ability to draw strong conclusions from the dataset both from upstream versus downstream and pre- versus post-discharge perspectives.

There was relatively high variability among the four replicates at some stations (e.g., Station DS1 Replicate A = 3 organisms; Replicate D = 86 organisms) which probably was due to the amount of sediment deposition on different samplers, which further complicated interpretation. It could be concluded that differences that did exist between upstream and downstream stations also were related to variable natural sediment deposition. Pre-discharge samples from UP1, which was covered with sediment, had a mean abundance of 2.5 compared to DS4 with 49 organisms, which had the least sediment deposition. DS4 is located in an area approximately 960 meters downstream of the Outfall 003 discharge, around a slight bend in the river where sediment deposition is not occurring at the same rate due to river hydrology characteristics which differ from the other stations.

The benthic community was very similar in the samples collected during the pre- and post-discharge surveys. Based on modeling and dye studies, the Hester-Dendy locations were expected to be in varying concentrations of the discharge plume. The only station where a difference was evident was at DS1 where pre-discharge mean abundance was 43 compared to post-discharge abundance of 0.3 organisms. This station had the highest between replicates variability (3 to 86 organisms) in the pre-discharge survey. DS1 is closest to Outfall 003 which may have resulted in scouring effects on the benthos reducing abundance in the post-discharge samplers, but this conclusion is only tentative considering the pre-discharge replicate variability.

The benthic community that was collected in the Hester-Dendy study (including replicates not covered by sediment) consisted of tolerant taxa which is a consequence of the rigorous naturally occurring environmental conditions they are exposed to on a periodic but regular basis. It is clear that a large sediment load goes through this area and the benthic community that is adapted to these conditions continues to exist. This can be placed into perspective using the information presented in Section 4.3.2 and Table 4-5 of this report. Based upon a 19 year historical dataset, the upper $10^{th}$ percentile daily sediment load value (24,174,000 kg/d) measured at the upstream end of the study area is approximately 157 times higher than the sediment load released from a typical discharge at Outfall 003 (24,174,000/153,600); and 1,358 times higher than the sediment load released from a typical discharge at Outfall 002 (24,174,000/17,800). Thus, the benthic community experiences a substantially larger sediment load from naturally occurring high-flow depositional events on a seasonal or periodic basis. Further, this tolerant community does not appear to differ based on the present study's upstream versus downstream station comparison. These results are generally consistent with the Dynamac (1992) study using a different sampling technique but also finding a tolerant benthic community. Based on our observations during this benthic study, interpretation of existing river and discharge sediment load data, and supporting information from past studies, intermittent Dalecarlia and Georgetown discharge events are not expected to have a substantial or cumulative impact on the tolerant benthic community present in this reach of the Potomac River.

## 6.4 REFERENCES

Dynamac Corporation. 1992. *Impacts of Sedimentation Basin Discharges from the Dalecarlia and Georgetown Reservoirs on the Potomac River; Final Report*. Prepared for Planning Division, U.S. Army COE Baltimore District. Report dated 1 September 1992.

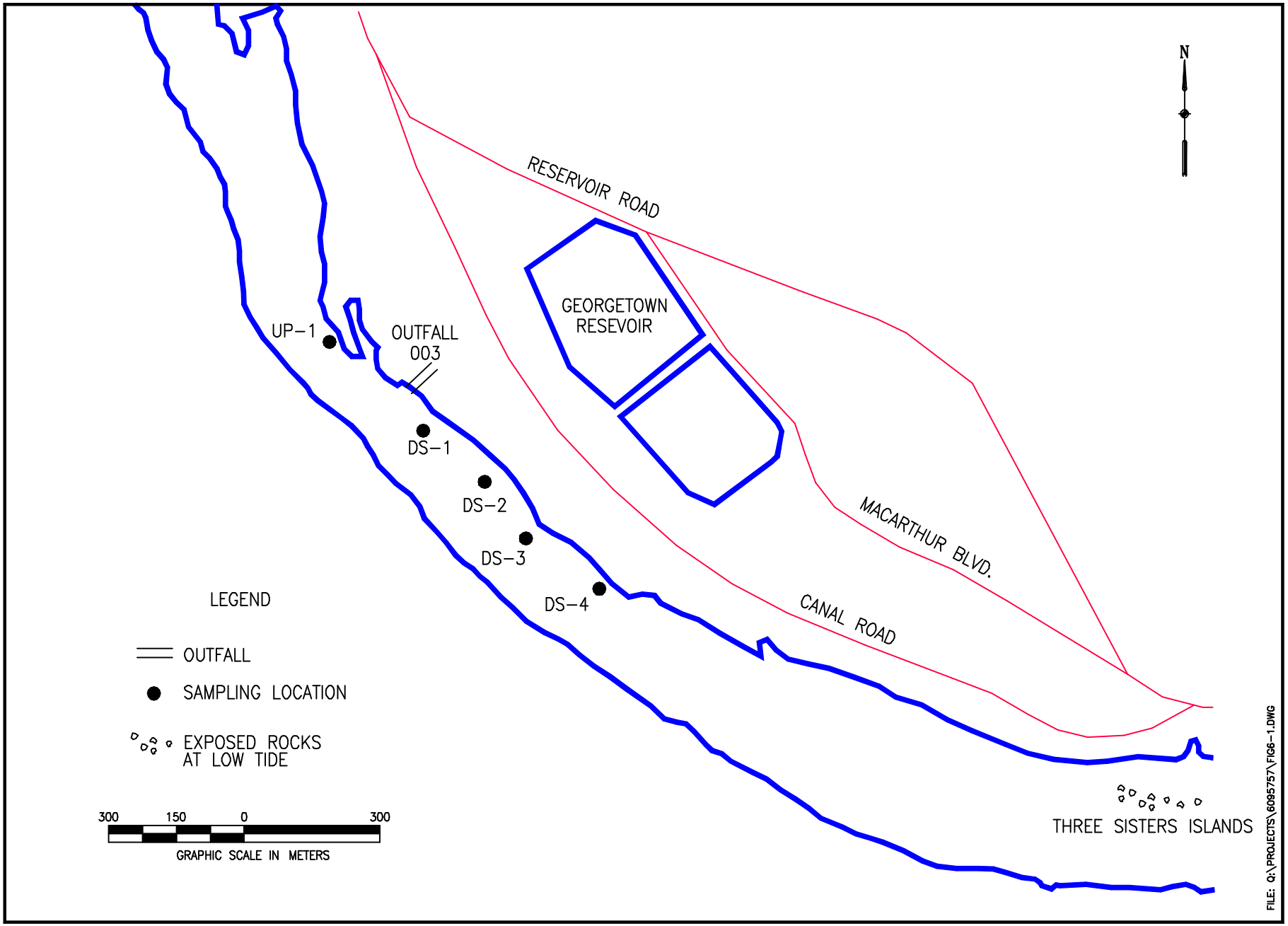


Figure 6–1. Locations of the Benthic Sampling Stations in the Vicinity of Outfall 003, April and May 2000

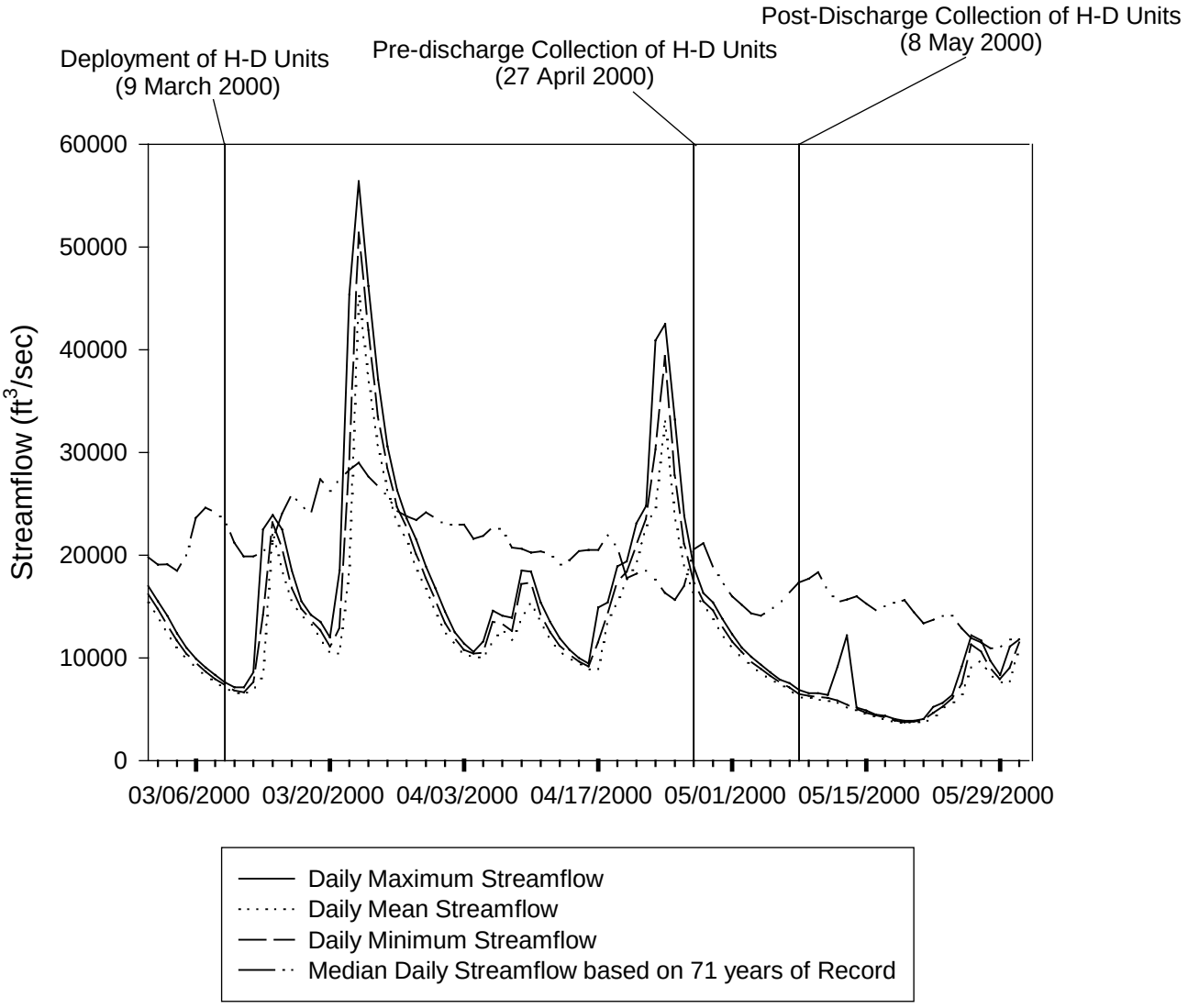


Figure 6-2. Potomac River flows (at Little Falls) for the benthic community study.

Photo 6-1. Hester-Dendy units on concrete block before placement.

Photo 6-2. Hester-Dendy marking at DS-2, (3-10-00).

Photo 6-3. Hester-Dendy upstream location, (5-8-00).

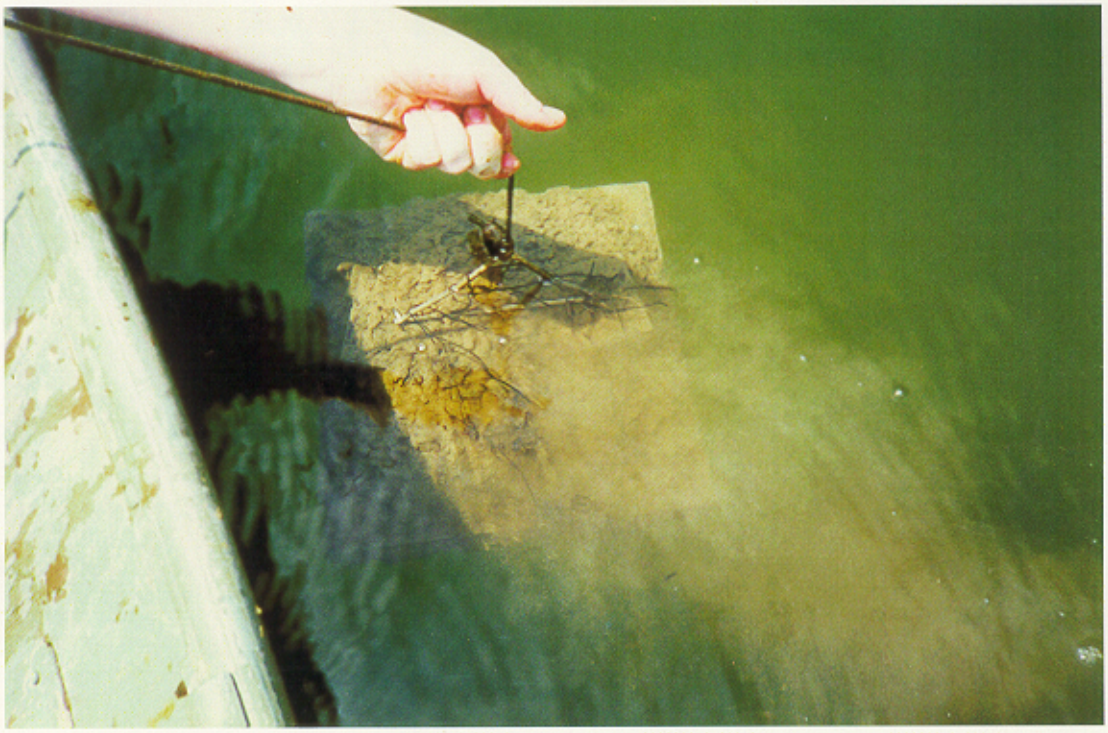

Photo 6-4. Gentle H-D removal at DS-3, (5-8-00).

TABLE 6-1 NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED ON 27 APRIL 2000 (PRE-DISCHARGE) CLASSIFIED BY MAJOR TAXONOMIC GROUP

| | STATIONS | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UP1 | | | | DS1 | | | | DS2 | | | | DS3 | | | | DS4 | | | |
| | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D |
| Nemertea | 2 | -- | 1 | -- | -- | -- | 1 | 2 | | | | | 1 | -- | -- | -- | -- | -- | -- | 1 |
| Oligochaeta | -- | 2 | -- | -- | -- | 8 | 7 | 16 | 5 | 3 | 2 | -- | 20 | 2 | 2 | 1 | -- | -- | 11 | 8 |
| Hirudinea | | | | | 1 | 1 | 1 | -- | | | | | | | | | | | | |
| Gastropoda | | | | | -- | 2 | 2 | 4 | | | | | 40 | 43 | -- | -- | 11 | 21 | 11 | 9 |
| Isopoda | | | | | -- | 2 | 4 | 4 | | | | | 3 | -- | -- | -- | -- | 1 | -- | 1 |
| Amphipoda | | | | | -- | -- | 11 | 32 | | | | | 34 | 7 | -- | -- | 10 | 31 | 14 | 14 |
| Hydrocarina | -- | -- | 1 | -- | -- | -- | -- | 1 | -- | -- | 4 | -- | | | | | | | | |
| Ephemeroptera | | | | | -- | 2 | 19 | 10 | | | | | 7 | 2 | -- | -- | 4 | 4 | 2 | 1 |
| Odonata | | | | | -- | -- | 3 | 1 | | | | | 1 | 1 | -- | -- | | | | |
| Trichoptera | | | | | -- | -- | -- | 1 | | | | | 2 | -- | -- | -- | -- | 1 | -- | -- |
| Coleoptera | | | | | 1 | -- | 8 | 5 | | | | | 2 | -- | 1 | -- | | | | |
| Chironomidae | -- | 2 | 1 | 1 | 1 | 3 | 8 | 10 | -- | 1 | -- | 1 | 10 | 5 | 2 | 1 | 10 | 7 | 24 | 1 |
| TOTAL | 2 | 4 | 3 | 1 | 3 | 18 | 64 | 86 | 5 | 4 | 6 | 1 | 120[(a)] | 60[(a)] | 5 | 2 | 35 | 65 | 62 | 35 |
| Mean | 2.5 | | | | 42.8 | | | | 4.0 | | | | 3.5 | | | | 49.3 | | | |

(a) Data not valid for comparison because the samples were moved to a different location (mid-stream).

TABLE 6-2 NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED ON 8 MAY 2000 (POST-DISCHARGE) CLASSIFIED BY MAJOR TAXONOMIC GROUP

| | STATION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UP1 | | | | DS1 | | | | DS2 | | | | DS3 | | | | DS4 | | | |
| | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D |
| Nemertea | | | | | | | | | 1 | -- | -- | -- | | | | | | | | |
| Oligochaeta | 9 | 11 | 5 | 4 | | | | | 7 | 2 | 7 | 3 | 1 | 2 | -- | 3 | -- | 2 | 4 | 3 |
| Hirudinea | | | | | | | | | | | | | | | | | | | | |
| Gastropoda | 1 | 1 | -- | 1 | | | | | | | | | -- | -- | -- | 3 | 9 | 10 | 8 | 7 |
| Isopoda | 7 | -- | -- | -- | | | | | | | | | | | | | | | | |
| Amphipoda | -- | -- | 2 | -- | | | | | | | | | | | | | 34 | 46 | 30 | 20 |
| Hydrocarina | | | | | | | | | 2 | -- | -- | -- | | | | | | | | |
| Ephemeroptera | 3 | -- | -- | 1 | | | | | | | | | 2 | -- | -- | 1 | 5 | 2 | -- | 1 |
| Odonata | | | | | | | | | | | | | -- | -- | -- | 1 | 1 | -- | -- | 1 |
| Trichoptera | | | | | | | | | | | | | | | | | -- | 1 | -- | -- |
| Coleoptera | 5 | 1 | -- | -- | | | | | | | | | | | | | -- | -- | 1 | 1 |
| Chironomidae | 1 | 2 | -- | 2 | -- | 1 | -- | -- | -- | 1 | -- | -- | | | | | 1 | 2 | 6 | 2 |
| TOTAL | 26 | 15 | 7 | 8 | 0 | 1 | 0 | 0 | 10 | 3 | 7 | 3 | 3 | 2 | 0 | 8 | 50 | 63 | 49 | 35 |
| Mean | 14.0 | | | | 0.3 | | | | 5.8 | | | | 3.3 | | | | 49.3 | | | |

TABLE 6-3 NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED ON 27 APRIL 2000 (PRE-DISCHARGE)

| | STATION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | UP1-A | UP1-B | UP1-C | UP1-D | DS1-A | DS1-B | DS1-C | DS1-D | DS2-A | DS2-B | DS2-C | DS2-D | DS3-A | DS3-B | DS3-C | DS3-D | DS4-A | DS4-B | DS4-C | DS4-D |
| | 2 | | 1 | | | | | | | | | | | | | | | | | |
| Prostoma sp. | | | | | | | | | | | | | | | | | | | | 1 |
| Eclipidrilus sp. | | | | | | | 1 | 2 | | | | | 1 | | | | | | | |
| Enchytraeidae | | | | | | | 1 | | | | | | | | | | | | | |
| Arcteonais lomondi | | 1 | | | | | | | | | | | | | | | | | | |
| Chaetogaster limnaei | | | | | | | | | | | | | | | | | | | | 7 |
| Dero sp. (inc.) | | | | | | | | | | | | | 1 | | | | | | | |
| Nais communis | | | | | | 1 | | 1 | | | | | 3 | | | | | | 8 | |
| Nais pardalis | | | | | | | 1 | 2 | | | | | 1 | | | | | | 1 | |
| Nais variabilis | | | | | | | | | | 1 | | | 2 | | | | | | 1 | |
| Nais sp. (inc. spec.) | | | | | | | | 1 | | | | | | | | | | | | |
| Paranais litoralis | | | | | | | | | | | | | | | 1 | | | | | |
| Pristina leidyi | | | | | | | | 3 | | | | | | | | | | | | |
| Slavina appendiculata | | | | | | 7 | 2 | 4 | | | | | 6 | | | | | | | |
| Specaria josinae | | | | | | | | 1 | | | | | | | | | | | | |
| Stylaria lacustris | | | | | | | 1 | 2 | | | | | 4 | 2 | | | | | 1 | 1 |
| Aulodrilus pigueti | | | | | | | | | | | | | | | | | | | | |
| Branchiura sowerbyi | | | | | | | | | | | 1 | | | | | | | | | |
| Ilyodrilus templetoni | | | | | | | | | | | | | | | 1 | | | | | |
| Quistadrilus multisetosus | | | | | | | 1 | 1 | | | | | 2 | | | | | | | |
| Limnodrilus hoffmeisteri | | 1 | | | | | | | 3 | | | | | | | 1 | | | | |
| Immature with hair chaetae | | | | | | | | | 1 | | | | 1 | | | | | | | |
| Immature without hair chaetae | | | | | | | 1 | 1 | 1 | 2 | 1 | | | | | | | | | |
| Desserobdella phalera | | | | | 1 | 1 | 1 | | | | | | | | | | | | | |
| Laevapex fuscus | | | | | | | | | | | | | | | | | | 2 | | |
| Laevapex diaphanus | | | | | | | | | | | | | | | | | 1 | | | |
| Ferrissia sp. | | | | | | 1 | | | | | | | | 1 | | | | | | |
| Physella sp. | | | | | | | | 1 | | | | | | | | | | 1 | | 1 |
| Gyraulus deflectus? | | | | | | | | | | | | | | | | | | | | |
| Menetes dilatatus | | | | | | | | | | | | | 1 | | | | | | | |
| unid. planorbid (inc.) | | | | | | | | | | | | | | | | | | | | 1 |
| Bithynia tentaculata | | | | | | | | | | | | | | | | | 1 | 3 | 2 | 2 |
| Amnicola limosa | | | | | | | 1 | 1 | | | | | 2 | | | | | | | |
| unid. hydrobiid (inc.) | | | | | | | | 1 | | | | | | | | | | | | |
| Pleurocera sp. | | | | | | 1 | 1 | 1 | | | | | 37 | 42 | | | 9 | 15 | 9 | 5 |
| Caecidotea sp. | | | | | | 2 | 4 | 4 | | | | | 3 | | | | | 1 | | 1 |
| Gammarus fasciatus | | | | | | | | 2 | | | | | 3 | | | | 4 | 16 | 2 | 2 |
| Gammarus pseudolimnaeus | | | | | | | | | | | | | | | | | | | 2 | |
| Gammarus sp. (imm.) | | | | | | | 11 | 30 | | | | | 31 | 7 | | | 6 | 15 | 10 | 12 |
| Koenikea sp. | | | 1 | | | | | | | | 4 | | | | | | | | | |
| Unionicola sp. | | | | | | | | 1 | | | | | | | | | | | | |
| Caenis sp. | | | | | | 2 | 19 | 10 | | | | | 7 | 1 | | | | | 1 | |
| Leucrocuta sp. | | | | | | | | | | | | | | | | | | | | |
| Stenacron interpunctatum | | | | | | | | | | | | | | 1 | | | 3 | 4 | 1 | 1 |
| Stenonema sp. | | | | | | | | | | | | | | | | | 1 | | | |
| Argia tibialis | | | | | | | | | | | | | 1 | | | | | | | |

TABLE 6-3 NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED ON 27 APRIL 2000 (PRE-DISCHARGE)

| | STATION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | UP1-A | UP1-B | UP1-C | UP1-D | DS1-A | DS1-B | DS1-C | DS1-D | DS2-A | DS2-B | DS2-C | DS2-D | DS3-A | DS3-B | DS3-C | DS3-D | DS4-A | DS4-B | DS4-C | DS4-D |
| Coenagrion/Enallagma sp. | | | | | | | | | | | | | | | | | | | | |
| Enallagma sp. | | | | | | | 1 | 1 | | | | | | | | | | | | |
| unid. coenagrionid (early instar) | | | | | | | 2 | | | | | | | | | | | | | |
| Neurocordulia obsoleta | | | | | | | | | | | | | | 1 | | | | | | |
| Ceraclea sp. | | | | | | | | 1 | | | | | 1 | | | | | | | |
| Neureclipsis sp. | | | | | | | | | | | | | 1 | | | | | | | |
| Polycentropus sp. | | | | | | | | | | | | | | | | | | 1 | | |
| Dubiraphia sp. | | | | | | | 1 | 1 | | | | | | | | | | | | |
| Macronychus glabratus | | | | | | | | | | | | | 1 | | | | | | | |
| Stenelmis sp. | | | | | 1 | | 5 | 4 | | | | | 1 | | 1 | | | | | |
| Berosus sp. | | | | | | | 1 | | | | | | | | | | | | | |
| Psephenus herricki | | | | | | | 1 | | | | | | | | | | | | | |
| Ablabesmyia sp. | | | | | | | 1 | 1 | | | | | 3 | 1 | | | 1 | 3 | 1 | |
| Brillia sp. | | | | | | | | | | | | | | | | | | | 1 | |
| Cardiocladius sp. | | | | | | | | 1 | | | | | | | | | | | | |
| Chironomus sp. | | | | | | 1 | | | | | | | 1 | | | | 1 | | | |
| Cladotanytarsus mancus-gr. | | | | | | | 1 | | | | | | | | | | | | | |
| Clinotanypus sp. | | | | | | | 1 | | | | | | | | 1 | | | | | |
| Corynoneura sp. | | | | | | | | | | | | | | | | | | 1 | 2 | |
| Cricotopus bicinctus | | | | | | | | | | | | | | | | | | | | |
| Cricotopus sp. | | | | 1 | | | | | | | | | | | | | | | | |
| Cryptochironomus sp. | | | | | | | | | | | | | | | | | | | | |
| Dicrotendipes sp. | | | | | | | | | | 1 | | | | | | | | | | |
| Endochironomus subtendens | | | | | | | | | | | | | | | | | 1 | 1 | | |
| Eukiefferiella sp. | | | 1 | | | | | | | | | | | | | | | | | |
| Micropsectra | | | | | | | | | | | | | | | | | 1 | | | |
| Nanocladius crassicornis | | | | | | | | | | | | | | | | | | | 3 | |
| Nilotanypus sp. | | | | | | | 1 | | | | | | | 1 | | | | | | |
| Parakiefferiella sp. | | | | | | | | | | | | | | | | | 2 | | 7 | |
| Paralauterborniella sp. | | | | | | | | 2 | | | | | | | | | | | | |
| Paratendipes albimanus-gr. | | | | | | 1 | | 1 | | | | | | | | | | | | |
| Polypedilum | | 1 | | | | | 4 | 2 | | | | | 4 | 2 | 1 | | 4 | 2 | 9 | 1 |
| Procladius sp. | | | | | | | | 1 | | | | | 1 | | | 1 | | | | |
| Tanytarsus sp. | | 1 | | | 1 | | | 1 | | | | | 1 | | | | | | | |
| Tanytarsus sp. (pupa) | | | | | | | | | | | | | | 1 | | | | | | |
| Unid. Chironomini - inc. | | | | | | | | 1 | | | | | | | | | | | | |
| Unid. Orthocladiinae - inc. | | | | | | | | | | | | 1 | | | | | | | | |
| Chironomidae - no head | | | | | | 1 | | | | | | | | | | | | | 1 | |
| | | | | | | | | | | | | | | | | | | | | |
| TOTAL BENTHOS | 2 | 4 | 3 | 1 | 3 | 18 | 64 | 86 | 5 | 4 | 6 | 1 | 120 | 60 | 5 | 2 | 35 | 65 | 62 | 35 |
| TOTAL TAXA | 1 | 4 | 3 | 1 | 3 | 9 | 25 | 28 | 2 | 3 | 3 | 1 | 27[(a)] | 11[(a)] | 5 | 2 | 13 | 13 | 17 | 10 |
| EPT TAXA | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 3[(a)] | 2[(a)] | 0 | 0 | 2 | 2 | 2 | 1 |

(a) Data not valid for comparison because the samplers were moved to a different location (mid-stream).

TABLE 6-4 NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED ON 8 MAY 2000 (POST-DISCHARGE)

| | STATION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | UP1-A | UP1-B | UP1-C | UP1-D | DS1-A | DS1-B | DS1-C | DS1-D | DS2-A | DS2-B | DS2-C | DS2-D | DS3-A | DS3-B | DS3-C | DS3-D | DS4-A | DS4-B | DS4-C | DS4-D |
| | | | | | | | | | 1 | | | | | | | | | | | |
| Prostoma sp. | | | | | | | | | | | | | | | | | | | | |
| Eclipidrilus sp. | | | | | | | | | | | | | | | | | | | | |
| Enchytraeidae | 1 | | | | | | | | | | | | | | | | | | | |
| Arcteonais lomondi | | 1 | | | | | | | | | | | | | | | | | | |
| Chaetogaster limnaei | | | | | | | | | | | | | | | | | | | | |
| Dero sp. (inc.) | | | | | | | | | | | | | | | | | | | | |
| Nais communis | | | | | | | | | | | | | | | | | | 1 | | |
| Nais pardalis | | | | | | | | | | | | | | | | | | | | |
| Nais variabilis | | | | | | | | | | | | | | | | | | | | |
| Nais sp. (inc. spec.) | | | | | | | | | | | | | | | | | | | 1 | |
| Paranais litoralis | | | | | | | | | | | | | | | | | | | | |
| Pristina leidyi | | | | | | | | | | | | | | | | | | | | |
| Slavina appendiculata | | | | | | | | | | | | | | | | | | | | |
| Specaria josinae | | | | | | | | | | | | | | | | | | | | |
| Stylaria lacustris | | | | | | | | | | | | | | | | | | 1 | 2 | 3 |
| Aulodrilus pigueti | | 1 | | | | | | | | | | | | | | | | | | |
| Branchiura sowerbyi | | | | | | | | | | | | | | | | | | | | |
| Ilyodrilus templetoni | | | 1 | | | | | | | | 1 | | 1 | | | | | | | |
| Quistadrilus multisetosus | 1 | | | | | | | | | | | | | | | | | | | |
| Limnodrilus hoffmeisteri | | 1 | 2 | 2 | | | | | 5 | 2 | 3 | 2 | | 2 | | | | | | |
| Immature with hair chaetae | 2 | 1 | | | | | | | | | | | | | | 1 | | | | |
| Immature without hair chaetae | 5 | 7 | 2 | 2 | | | | | 2 | | 3 | 1 | | | | 2 | | | 1 | |
| Desserobdella phalera | | | | | | | | | | | | | | | | | | | | |
| Laevapex fuscus | | | | | | | | | | | | | | | | | | | 1 | |
| Laevapex diaphanus | | | | | | | | | | | | | | | | | | | | |
| Ferrissia sp. | | | | | | | | | | | | | | | | | | | | |
| Physella sp. | 1 | | | | | | | | | | | | | | | | | 1 | | 1 |
| Gyraulus deflectus? | | | | | | | | | | | | | | | | | | 1 | | |
| Menetes dilatatus | | | | | | | | | | | | | | | | | | | | |
| unid. planorbid (inc.) | | | | | | | | | | | | | | | | | | | | |
| Bithynia tentaculata | | | | | | | | | | | | | | | | | | 3 | | 1 |
| Amnicola limosa | | 1 | | 1 | | | | | | | | | | | | 2 | | | 1 | 2 |
| unid. hydrobiid (inc.) | | | | | | | | | | | | | | | | | | | | |
| Pleurocera sp. | | | | | | | | | | | | | | | | 1 | 9 | 5 | 6 | 3 |
| Caecidotea sp. | 7 | | | | | | | | | | | | | | | | | | | |
| Gammarus fasciatus | | | 2 | | | | | | | | | | | | | | 14 | 17 | 16 | 11 |
| Gammarus pseudolimnaeus | | | | | | | | | | | | | | | | | | | | |
| Gammarus sp. (imm.) | | | | | | | | | | | | | | | | | 20 | 29 | 14 | 9 |
| Koenikea sp. | | | | | | | | | 2 | | | | | | | | | | | |
| Unionicola sp. | | | | | | | | | | | | | | | | | | | | |
| Caenis sp. | 3 | | | 1 | | | | | | | | | 2 | | | 1 | | | | |
| Leucrocuta sp. | | | | | | | | | | | | | | | | | 2 | | | |
| Stenacron interpunctatum | | | | | | | | | | | | | | | | | 3 | 2 | | 1 |
| Stenonema sp. | | | | | | | | | | | | | | | | | | | | |
| Argia tibialis | | | | | | | | | | | | | | | | | | | | |

TABLE 6-4 NUMBER OF BENTHIC MACROINVERTEBRATES COLLECTED ON 8 MAY 2000 (POST-DISCHARGE)

| | STATION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | UP1-A | UP1-B | UP1-C | UP1-D | DS1-A | DS1-B | DS1-C | DS1-D | DS2-A | DS2-B | DS2-C | DS2-D | DS3-A | DS3-B | DS3-C | DS3-D | DS4-A | DS4-B | DS4-C | DS4-D |
| Coenagrion/Enallagma sp. | | | | | | | | | | | | | | | | 1 | | | | |
| Enallagma sp. | | | | | | | | | | | | | | | | | 1 | | | 1 |
| unid. coenagrionid (early instar) | | | | | | | | | | | | | | | | | | | | |
| Neurocordulia obsoleta | | | | | | | | | | | | | | | | | | | | |
| Ceraclea sp. | | | | | | | | | | | | | | | | | | 1 | | |
| Neureclipsis sp. | | | | | | | | | | | | | | | | | | | | |
| Polycentropus sp. | | | | | | | | | | | | | | | | | | | | |
| Dubiraphia sp. | 1 | 1 | | | | | | | | | | | | | | | | | | |
| Macronychus glabratus | | | | | | | | | | | | | | | | | | | 1 | 1 |
| Stenelmis sp. | 4 | | | | | | | | | | | | | | | | | | | |
| Berosus sp. | | | | | | | | | | | | | | | | | | | | |
| Psephenus herricki | | | | | | | | | | | | | | | | | | | | |
| Ablabesmyia sp. | | | | | | | | | | | | | | | | | | | 1 | |
| Brillia sp. | | | | | | | | | | | | | | | | | | | | |
| Cardiocladius sp. | | | | | | | | | | | | | | | | | | | | |
| Chironomus sp. | 1 | | | | | | | | | | | | | | | | | | | |
| Cladotanytarsus mancus-gr. | | | | | | | | | | | | | | | | | | | | |
| Clinotanypus sp. | | | | | | | | | | | | | | | | | | | | |
| Corynoneura sp. | | | | | | | | | | | | | | | | | | | | |
| Cricotopus bicinctus | | | | 2 | | 1 | | | | | | | | | | | | 1 | | |
| Cricotopus sp. | | | | | | | | | | | | | | | | | | | | 1 |
| Cryptochironomus sp. | | | | | | | | | | 1 | | | | | | | | | | |
| Dicrotendipes sp. | | | | | | | | | | | | | | | | | | | | |
| Endochironomus subtendens | | | | | | | | | | | | | | | | | | | | |
| Eukiefferiella sp. | | | | | | | | | | | | | | | | | | | | |
| Micropsectra | | | | | | | | | | | | | | | | | | | | |
| Nanocladius crassicornis | | | | | | | | | | | | | | | | | | | | |
| Nilotanypus sp. | | | | | | | | | | | | | | | | | | | | |
| Parakiefferiella sp. | | | | | | | | | | | | | | | | | | | 1 | |
| Paralauterborniella sp. | | | | | | | | | | | | | | | | | | | | |
| Paratendipes albimanus-gr. | | | | | | | | | | | | | | | | | | | | |
| Polypedilum | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 |
| Procladius sp. | | 2 | | | | | | | | | | | | | | | | | 3 | |
| Tanytarsus sp. | | | | | | | | | | | | | | | | | | | | |
| Tanytarsus sp. (pupa) | | | | | | | | | | | | | | | | | | | | |
| Unid. Chironomini - inc. | | | | | | | | | | | | | | | | | | | | |
| Unid. Orthocladiinae - inc. | | | | | | | | | | | | | | | | | | | | |
| Chironomidae - no head | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| TOTAL BENTHOS | 26 | 15 | 7 | 8 | 0 | 1 | 0 | 0 | 10 | 3 | 7 | 3 | 3 | 2 | 0 | 8 | 50 | 63 | 49 | 35 |
| TOTAL TAXA | 9 | 6 | 3 | 4 | 0 | 1 | 0 | 0 | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 6 | 7 | 12 | 13 | 12 |
| EPT TAXA | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 | 0 | 1 |